

An Overview of Iron Deficiency Anemia in Children Ages 0-5

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for
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Iron Deficiency Anemia (IDA): What is it?

IDA occurs when iron stores in the body are gone and/or the transport of iron is reduced, causing hemoglobin levels (the oxygen carrying portion in red blood cells) to fall below a healthy level. Oxygen is necessary for life, growth, and health. Red blood cells deliver the life giving oxygen from our lungs throughout the body. If oxygen were the passengers, red-blood cells the cars, and iron the assembly-lines building the cars, IDA would look like this: The assembly-line building the cars start shutting down one by one, resulting in fewer and fewer cars driving on the roads, causing more and more important passengers to not reach such important destinations as the brain, the heart, and the muscles.

IDA is defined as children with absent iron stores and/or reduced iron transport (abnormal value for at least two of the following three indicators: serum ferritin, transferrin saturation, and free erythrocyte protoporphyrin) and anemia based on the following criteria: in ages 6 months to 2 years, those with Hb concentration of 11.0 g/dL and Hct <32.9%; and children 2 to 5 as those with Hb concentration of 11.1 g/dL and Hct <33.0% [Center for Disease Control's (CDC's) 1998 recommendations]. Healthy Beginnings uses the California Department of Health Services 'Child Health and Disability Prevention (CHPD) Program - Criteria and Recommendations for Managing Anemia' (issued 2/3/1997, and based on CDC's 1989 recommendations), and the following are considered anemic: in ages less than 2 years, those with Hb concentration of 11.0 g/dL and Hct <33%; and children 2 to less than 5 as those with Hb concentration of 11.2 g/dL and Hct <34.0%.

The Dangers of IDA

IDA in children ages 0-5 can result in behavioral, cognitive, and psychometric deficits, as well as decreased immune function, even in mild cases. These impairments can lead to decreased motor activity, social interaction, and attention to tasks, just to mention a few. Simply put, the child's body and brain are not getting enough oxygen to run well, so it begins running poorly on all levels. If the problem is not addressed and reversed, the developmental delays can persist past school-age and may even result in irreversible deficits. The danger of irreversible developmental delays due to a temporary nutritional deficiency emphasizes the importance of prevention, especially since the risk of IDA during this period depends largely on diet. IDA can also contribute to lead poisoning because it heightens the gastrointestinal tract's ability to absorb heavy metals.

Iron Deficiency (ID) vs. Iron Deficiency Anemia (IDA): What is the difference?

The term Iron Deficiency (ID) is often misused and confused with IDA. Iron Deficiency is a generalized term to indicate one of the following conditions: Iron Depletion or Iron Deficiency Erythropoiesis (see Table 1). The health of a child with ID is potentially at risk; the health of a child with IDA is in danger. The health risks of ID are not as well researched and defined as those of IDA, but studies have shown that ID in children may result in developmental and behavioral disturbances.

Table 1: Defining Status of Body Iron Content

Iron Status		Stored Iron	Transport Iron	Functional Iron
Iron Deficiency Anemia	IDA	Low	Low	Low
Iron Deficient Erythropoiesis	ID	Low	Low	Normal
Iron Depletion		Low	Normal	Normal
Normal	Norm	Normal	Normal	Normal

IDA: General Population vs. High-Risk Population

According to the CDC, using data from National Health and Nutrition Examination III survey, prevalence of IDA among the general population is low. But, it is important to keep in mind that ID and IDA are more common among the high-risk populations that are served by Head Start and State Preschools, which represent a portion of the Healthy Beginnings population. A more accurate gauge of the prevalence of IDA among high-risk groups is the Pediatric Nutrition Surveillance System (PedNSS), which monitors low-income children involved in federally funded maternal and child health nutrition.

What test should be used?

Table 2: General Population ID/IDA Rates and High-Risk Population Anemia Rates

Age Group	NHANES III - National	NHANES III - National	PedNSS~ California	PedNSS~ Shasta County
	ID	IDA	Anemia	Anemia
Ages 0 - 2 years	9%	3%	17.1%	13.3%
Ages 3 - 5 years	3%	<1%	13.8%	11.9%

* National Health and Nutrition Examination Survey, conducted during 1988-1994. ~Pediatric Nutrition Surveillance System, conducted in 1999. The PedNSS does not distinguish between IDA and other forms of anemia, but IDA is the most common form of anemia in the United States.

The CDC recommends using the Hemoglobin (Hb) Concentration and Hematocrit (Hct) to screen for IDA because of its low cost, and the ease and speed with which the test can be performed. Because changes in Hb concentration and Hct occur only in the late stages of iron deficiency, the test is a late indicator of iron deficiency; nevertheless, the test is essential for determining IDA. This is the most common test in clinical and public health settings for screening anemia. Routine testing for ID is not commonly done because it requires biochemical tests to assess iron status, which are more complex and more expensive.

Who should be tested?

The Center for Disease Control (CDC) does not recommend blood screening for IDA in the general infant population. The CDC does recommend screening for IDA all high risk infants and

high risk preschool children, and those in non-high risk populations with known risk factors. These populations are described in Table 3.

Table 3: CDC High Risk Populations and Risk Factors

High Risk Populations	Screening Suggestions
Children from low-income families Children eligible for WIC Migrant Children Recently arrived refugee children	Screen all between 9-12 months, then 6 months later, and annually from ages 2 to 5 years
Risk Factors Among Non-High Risk Populations	Screening Suggestions
Preterm Infants Low birthweight infants who are not fed iron-fortified infant formula	Consider screening at 6 months
Preterm/low birthweight infants Infants fed diet of non-iron-fortified infant formulas for >2 months Infants fed cow's milk before age 12 months Breast-fed infants who have a diet of inadequate iron after 6 months Children who drink >24 ounces daily of cow's milk Children with special healthcare needs	Screen between 9-12 months, then 6 months later
Children with low iron diets Children with limited access to food due to poverty or neglect Children with special healthcare needs	Screen annually ages 2-5 years

Treatment

- The CDC recommended treatment of IDA for children ages 0-5 is 3mg/kg per day of iron drops to be given between meals and counseling parents/guardians about proper diet (see below) to correct the problem of low iron intake.
- Repeat anemia screening in 4 weeks. An increase in Hb concentration of 1 g/dL or in Hct of 3% confirms the diagnosis of iron deficiency anemia. If confirmed, reinforce dietary counseling, and continue iron treatment for 2 more months, then recheck Hb concentration or Hct. Retest approximately 6 months after successful treatment is completed.
- If after 4 weeks the anemia does not respond to iron treatment, follow-up laboratory test (mean cell volume, red blood cell distribution width, and serum ferritin concentration) can be used to differentiate between iron deficiency anemia and anemia due to other causes.

Prevention

Primary prevention of iron deficiency should be done through diet for infants and preschool children. Among the CDC recommendations are:

- breastfeeding for the first 6 to 12 months of age;
- if using formula, use only iron-fortified formula;
- no cow's milk during the first 12 months, less than 24 oz of cow's milk, goat's milk, and soy milk from ages 1-5;
- when solid foods are introduced at 4-6 months it should be with iron-fortified cereals;
- encourage feeding one per day of foods rich in vitamin C (fruits, vegetables, or juice) with meals to improve iron absorption;
- add plain, pureed meats after 6 months or when the infant ready for such food.

The Recommended Dietary Allowances for iron are: ages 0-6 months is 0.27 mg/d (adequate intake), ages 7-12 months is 11 mg/d, ages 1-3 years is 7 mg/d, and ages 4-5 is 10 mg/d. Foods that are rich in iron are: breast milk, formula w/ iron, infant cereals, iron-fortified cereals, prune juice, eggs, meat, fish, chicken, turkey, dried beans, peanut butter, peas, lentils, molasses, raisins, spinach, and kale. There are two types of iron found in foods and the body absorbs them differently. Heme iron is found only in meat, poultry, and fish and is two to three times more absorbable than non-heme iron (which is found in plant-based foods and iron-fortified foods). Non-heme iron absorbability can be increased by including enhancers of iron absorption in the meal (an unknown component of meat and vitamin C).

Conclusion:

The national percentages of ID and IDA do not accurately reflect the rates among approximately 50% of the clients being served by Healthy Beginning. According to the CDC criteria, the Healthy Beginnings' low-income clients attending Head Start and State Preschools, are at a higher risk for ID and IDA.

Young children are particularly susceptible to iron deficiency due to their increased iron needs for rapid growth and the relatively low iron content of their diets when iron is not added via fortification or supplementation. The importance of preventing this temporary nutritional deficiency is underscored when you consider the potential threat of irreversible developmental delay.

Sources

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